AV & AVS Education

Your child is our responsibility.

Website - Avashishbhaiya.com

Notes available – PDFs, PYQs, Sample paper, Imp. Que.

Reflection of light

Light- light is a form of energy, which induces the sensation of vision in our eyes and makes us able to see various things present in our surrounding.

Note: we detect light with our eyes.

Luminous objects are objects that generate their own light.

Example: sun, bulb, tube light, glow worms, Stars, Torch etc.

Non-luminous object is one that does not produce its own light.

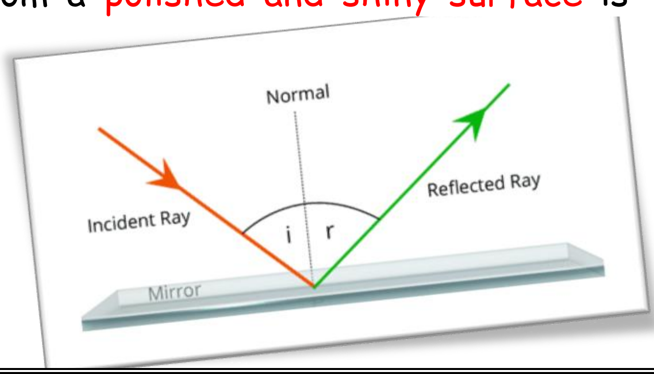
Example: Moon, tree, table, painting etc.

Property of Light

- It is form of energy
- It travels in straight line
- Light can form shadows
- Speed of light in air/ vacuum is $3X10^8$ m/s
- Light have dual nature-
  1. As a particle 2. As a wave

REFLECTION OF LIGHT

The bouncing back of rays of light from a polished and shiny surface is called reflection or reflection of light.



Note: A highly polished surface, such as a mirror, reflects most of the light falling on it. And dull/rough surfaces reflects less light

General terms related to plane mirrors:

Incident ray– An incident ray is a ray of light that strikes on the surface.

Reflected ray– A ray that represents the light reflected by the surface.

Point of incidence– The point of incidence is the point where the ray of incidence strikes the mirror.

Normal– Normal is a line perpendicular to mirror drawn at point of incidence.

Angle of incidence– Angle between incident ray and normal, called angle of incidence. It is denoted by i.

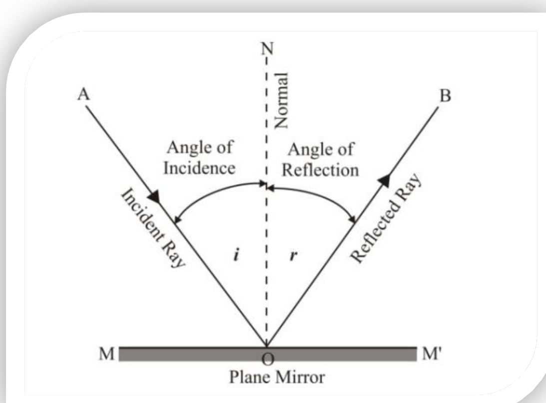
Angle of reflection– Angle between reflected ray and normal, called angle of reflection. It is denoted by r.

Laws of Reflection of light:

The two laws of reflection are:

i) The angle of incidence is equal to the angle of reflection,

ii) The incident ray, the normal to the mirror at the point of incidence and the reflected ray, all lie in the same plane.



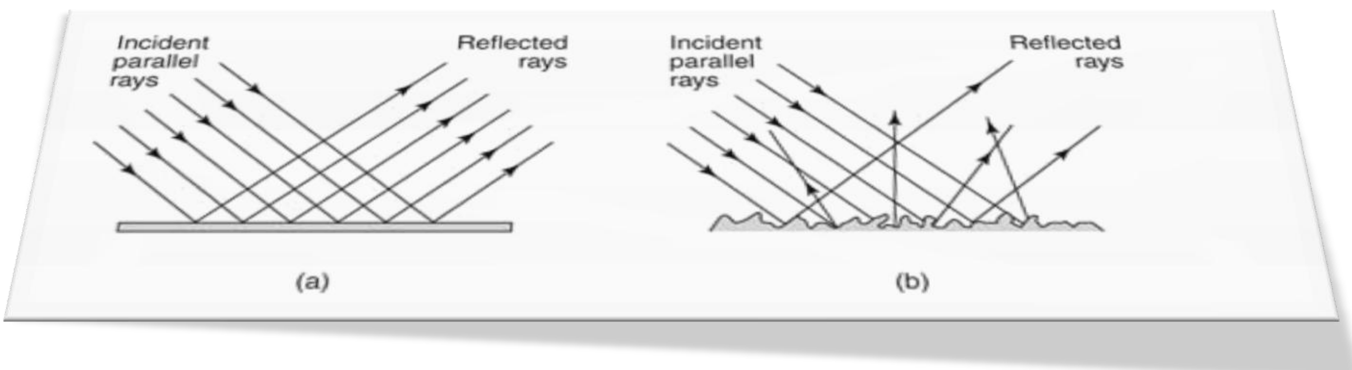
Types of reflection

Regular reflection: When the reflection surface is smooth and well-polished, the parallel rays falling on it are reflected parallel to another one.

Example: plane mirror, reflection from still water etc

Diffused reflection: When the reflecting surface is rough, the parallel rays falling on it are reflected in different direction. Such a reflection is known as diffuse reflection or irregular reflection.

Example: reflection of light from the wall of a room or tree etc



Lateral inversion:

When an object is placed in front of the plane mirror, sides are reversed. Right becomes left and left becomes right. This reversal is only in the direction perpendicular to the surface of the mirror.

Image: Image is the point where light rays meet or appear to meet.

Image can be of two types:

Real image- A real image occurs where rays converge,

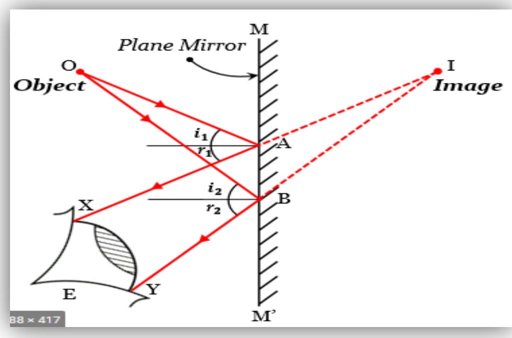
Example: light rays actually meet at image. They can be projected on screen

Virtual image – virtual image occurs where rays only appear to converge, Example: light rays appear to meet at image. They cannot be projected on screen

Property of image formed by plane mirror:

- Image is virtual and cannot be projected on screen
- Image is erect
- Image is of the same size as the object
- Laterally inverted
- Distance of image and object from the plane mirror is same

Formation of image in plane mirror



Uses of plane mirror

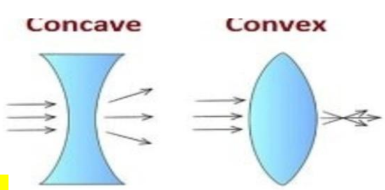
- To see ourselves
- To make some instruments like periscope
- In shops for decoration

Spherical mirrors

The curved surface of a shining spoon could be considered as a curved mirror. The most commonly used type of curved mirror is the spherical mirror.

Types of Spherical Mirror

1. A spherical mirror whose outer surface is polished and inner side is the reflecting surface is called concave mirror. A concave mirror is also known as converging mirror.



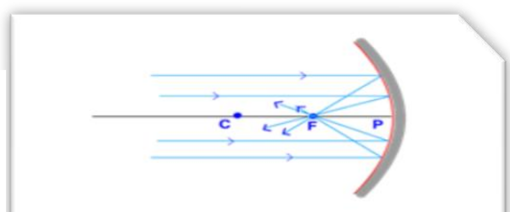


Fig: Converging Mirror(concave)

Use of concave mirror

Makeup mirror, Dental mirror, solar furnace, Headlight, Telescope, Microscope, Shaving mirror etc

Properties of concave mirror

Real, inverted and enlarge images are always formed.

2. A spherical mirror, spherical mirror whose inner is polished and outer side is the reflecting surface is called convex mirror. A convex mirror is also known as diverging mirror.

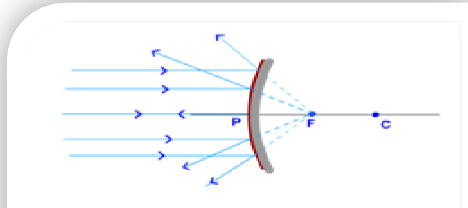
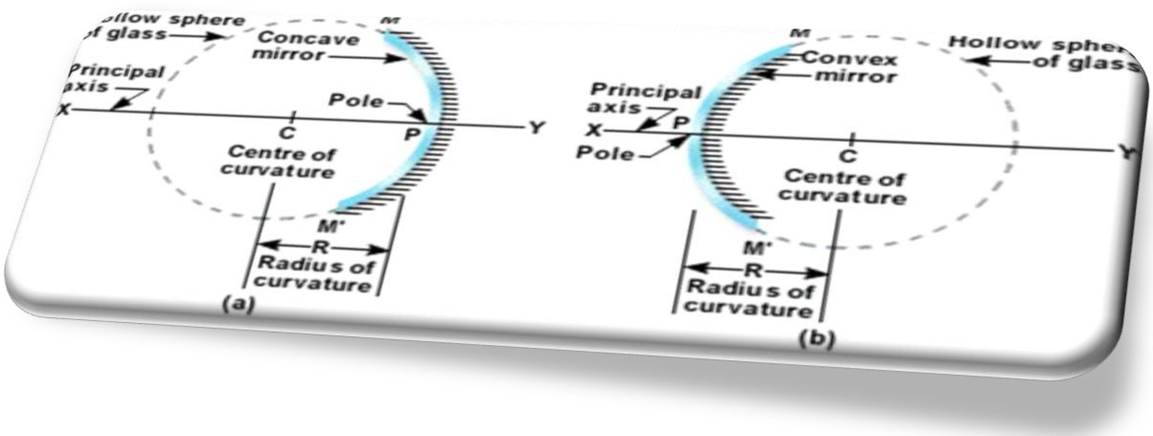


Fig: Diverging Mirror(convex)

Properties of convex mirror

Virtual, erect and diminished images are always formed.



Pole: The centre of reflecting surface of a spherical mirror is known as Pole. Pole is generally represented by 'P'.

Centre of Curvature: Sphere has a centre. This point is called the centre of curvature of the spherical mirror. It is represented by the letter C.

Radius of Curvature: The radius of sphere of which the reflecting surface of a spherical mirror is a part is called the Radius of Curvature of the spherical mirror. It is denoted by letter 'R'.

Aperture: The diameter of reflecting surface of a spherical mirror is called aperture. It is denoted by M_1, M_2

Principal Axis: Imaginary line passing through the centre of curvature and pole of a spherical mirror is called the Principal Axis. It is denoted by X and Y.

Focus or Principal Focus: Point on principal axis at which parallel rays coming from infinity converge after reflection is called the Focus. Focus is represented by letter 'F'.

Focal length: The distance from pole to focus is called focal length. Focal length is denoted by letter 'f'. Focal length is equal to half of the radius of curvature.

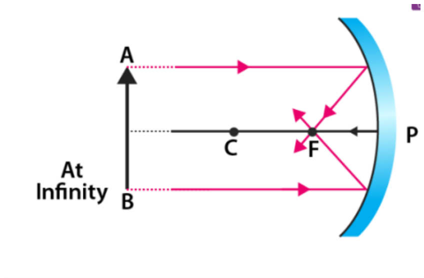
$$Or, f = \frac{R}{2} \qquad Or, R = 2f$$

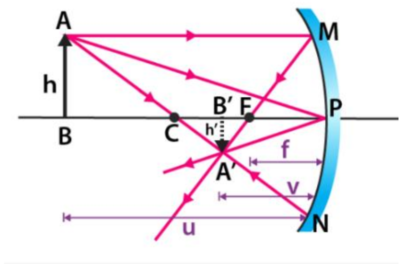
Formation of image in concave mirror

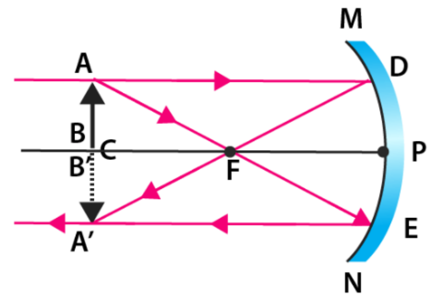
There is some case-

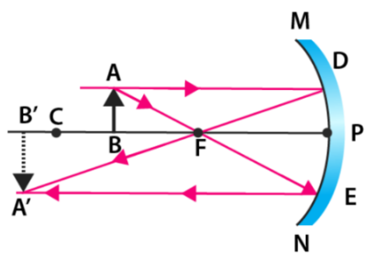
1. Between the P and F
2. At the F
3. Between the F and C
4. At the center
5. Beyond the C
6. Infinite

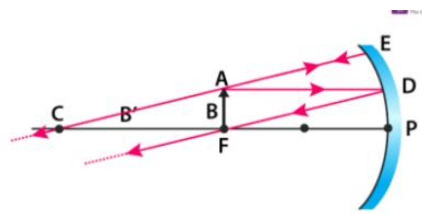
Formation of image by a concave mirror -

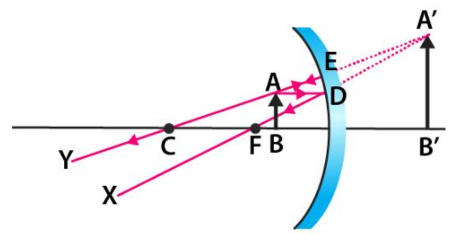








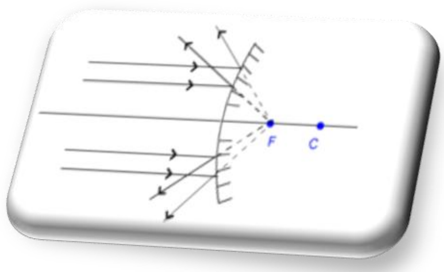


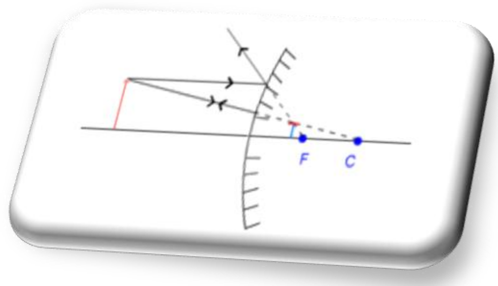


Position of the object	Position of the image	Size of the image	Nature of the image
At infinity	At the focus F	Highly diminished, point sized	Real and inverted
Beyond C	Between F and C	Diminished	Real and inverted
At C	At C	Same size	Real and inverted
Between C and F	Beyond C	Enlarged	Real and inverted
At F	At infinity	Highly enlarged	Real and inverted
Between P and F	Behind the mirror	Enlarged	Virtual and erect

Formation by a convex mirror

There are only two possibilities of position of object in the case of a convex mirror, i.e. object at infinity and object between infinity and pole of a convex mirror.





Position and Nature of Image in Convex Mirror

Position of object	Position of image	Size of image	Nature of image
At infinity	At F, behind mirror	Highly diminished	Virtual and Erect
Between infinity and pole	Between F and P, behind mirror	Diminished	Virtual and Erect

Uses of concave mirror:

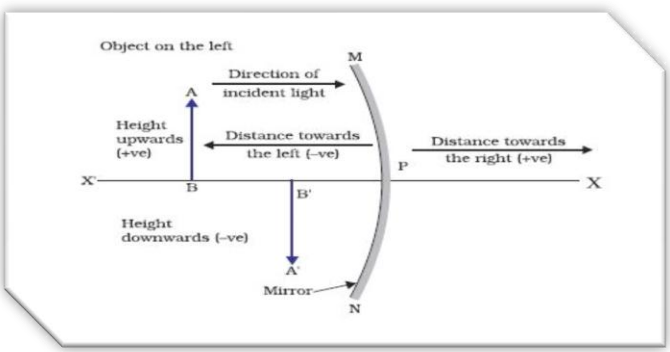
1. torches, search-lights and vehicles headlights to get powerful parallel beams of light
2. As shaving mirror
3. It is used by dentists to see larger image of teeth of the patient
4. As reflector in solar furnace
5. In doctor’s head mirror to see various body parts like nose, ears etc.
6. In dish TV antennas to focus signals

Uses of convex mirrors

1. It is used in rear view mirror of vehicles.
2. In big shops for security

Sign Convention for Reflection by Spherical Mirrors

1. All distances parallel to the principal axis are measured from the pole of the mirror.
2. All the distances measured to the right of the origin (along + x-axis) are taken as positive while those measured to the left of the origin (along – x-axis) are taken as negative.
3. Distances measured perpendicular to and above the principal axis (along + y-axis) are taken as positive.
4. Distances measured perpendicular to and below the principal axis (along –y-axis) are taken as negative



	Concave mirror		Convex mirror
	Real image	Virtual image	
Distance of object	$u \rightarrow -$	$u \rightarrow -$	$u \rightarrow -$
Distance of image	$v \rightarrow -$	$v \rightarrow +$	$v \rightarrow +$
Focal length	$f \rightarrow -$	$f \rightarrow -$	$f \rightarrow +$
Height of object	$h_o \rightarrow +$	$h_o \rightarrow +$	$h_o \rightarrow +$
Height of image	$h_i \rightarrow -$	$h_i \rightarrow +$	$h_i \rightarrow +$
Radius of curvature	$R \rightarrow -$	$R \rightarrow -$	$R \rightarrow +$
Magnification	$m \rightarrow -$	$m \rightarrow +$	$m \rightarrow +$

Magnification

Magnification is the ratio of the height of the image to the height of the object. It is usually represented by the letter 'm'.

$$Magnification(m) = \frac{Height\ of\ image\ (h')}{Height\ of\ object\ (h)}$$

$$Or, \quad m = \frac{h'}{h}$$

$$Magnification\ (m) = \frac{Distance\ of\ image}{Distance\ of\ object} = -\frac{v}{u}$$

$$Thus,\ m = \frac{h'}{h} = -\frac{v}{u}$$